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THE DESIGN, DEVELOPMENT AND TESTING OF AN INSECTICIDE HAND DUSTER

By

E.H. ADAMS AND R.B.E. STUBBS

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Porton Technical Paper No. 348

Date 8 MAY 1953

The Design, Development and Testing
of an Insecticide Hand Duster

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SUMMARY

An insecticide hand duster of novel design, has been developed and a few prototypes have been constructed. One of these has been submitted to both mechanical and performance tests, the results of which indicate that the standard of performance is such that submission of the remaining prototypes to the War Office for user trials is warranted.

From the results of the tests carried out it is concluded that when Anti-Louse Powder A.L. 63 Mk.3 is employed in the duster no matter in which plane the discharge nozzle may be held, the rate of discharge will be reasonably constant.

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I. Introduction

The War Office requirement for an insecticide hand duster calls for an equipment which, by the application of anti-lice powder, will be suitable for the de-lousing of personnel, blankets and bedding. Details of the outline specification for the hand duster are given in Appendix A attached.

In satisfaction of the War Office requirement an insecticide hand duster (hereinafter referred to as the "Duster") has been designed and developed and a few prototype models have been constructed. One of these has been subjected to performance tests.

An account of this work is reported herein.

II. Design Data

It has been estimated (1) that about 43 g. of insecticide powder, applied in 25 separate quantities is required for the de-lousing of one man and four blankets. Hence the appropriate rate of dispensation of powder required is about 1.7 g. per application. If it is assumed that each application will be associated with two strokes of an air pump, the rate of discharge of powder to be secured is approximately 0.9 g. per stroke.

III. Development

It will be noted that Clause 1 of the specification at Appendix A requires that the equipment shall be suitable for the de-lousing of personnel. This requirement pre-supposes that the duster must be capable of discharging a constant weight of insecticide dust, irrespective of whether the discharge tube be pointed downwards, e.g. when inserted between the body and the underpant waist band, or upwards, e.g. when inserted between the ankle and the trouser leg. Since previous experience

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in the operation of a variety of Trade dusters had shown that such dusters are markedly inefficient in this respect, it was obvious from the outset that a completely novel design which would ensure a constant rate of discharge of powder when operated at any angle in the vertical plane, would have to be developed.

Other considerations influencing the design were that the duster should be self-contained, of robust construction, of minimum size and weight, capable of operation either by hand or by compressed air and, in the interests of financial economy, constructed as far as possible from standard components, i.e. components which under normal circumstances would be obtainable from stocks held by the Trade.

The conventional duster consists essentially of an air pump, a dust reservoir and a discharge tube, fitted rigidly together. A fixed metal tube the "dip tube", which serves to direct the air delivered by the pump into the dust reservoir, extends throughout the depth of the latter. When the duster is held in the horizontal plane with the discharge tube uppermost (see Figure 1(a)) the air pumped into the dust reservoir passes down the dip tube, through the dust residing on the base (a quantity of which is thereby entrained) and finally makes an exit through the discharge tube.

Since the position of the dip tube in relation to the dust reservoir is fixed, rotating the latter through an arc of 180° or tipping it either upwards or downwards results in a change in the position of the dip tube relative to the powder because the latter being free flowing, moves until its surface lies in the horizontal plane. For example when the duster is operated in the horizontal plane with the discharge tube undermost, see Figure 1(b), the air entering the dust reservoir merely tends to compact the mass of powder and cause a blockage in the discharge tube. Similarly, when the duster is held with the discharge tube pointing vertically upwards, see Figure 1(c), blockage of the discharge tube again occurs. When the duster is held with the discharge tube pointing vertically downwards, however, (see Figure 1(d)), the air entering the dust reservoir passes through the dust residing on the base and a normal discharge of the air/dust mixture takes place.

It was thought at first that the defects described above could be best overcome by designing a duster in which the discharge tube would be centrally disposed and in which the dust reservoir would be free to rotate in the vertical plane. Such a design would ensure that both the dip tube and the powder in the reservoir, would maintain the same relative position irrespective of the angle at which the discharge tube might be held. Accordingly an experimental model (No.1), based on this principle of operation, was constructed and tested.

Experimental Model No.1 is illustrated in Figs. 2. (a), (b), (c) and (d). Figures 2.(b), (c) and (d) demonstrate the maintenance of the dust reservoir in the horizontal plane, irrespective of whether the discharge tube be pointing horizontally (Fig. 2(b)), downwards (Fig. 2(c)) or upwards (Fig. 2(d)).

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The results of the tests carried out on Experimental Model No.1 showed that while the principle of operation was sound, handling difficulties associated with the weight, size and shape of the model made it unsuitable for Service use. It was decided, therefore, to proceed with a design in which the dip tube, within the dust reservoir, would be free to rotate in the vertical plane, under the influence of the force of gravity and thus maintain its position relative to the position of the powder.

A design was prepared which embodied an air pump, a dust reservoir and a discharge tube, rigidly connected together. The dimensions of the bore and stroke of the pump and the internal diameter of the discharge tube, were selected with the object of securing a rate of discharge of about 0.9 g. of powder for each stroke of the pump. Through the centre of the dust reservoir which was designed to be roughly cylindrical in shape, provision was made for an open ended tube to be fitted. It was envisaged that this tube, which would be blanked off about one third of the way along its length and would contain a number of holes drilled to provide access to the dip tube and the container respectively, would not only provide an axis, about which the dip tube could rotate, but would provide at one end an entrance for the air expelled from the pump and at the other end an exit for the air/powder mixture, during the passage of the latter from the base of the dip tube to the discharge tube. It was anticipated, also, that the movements of the dip tube would serve to keep the dust agitated and thus preclude any tendency for cavitation to occur. The flow paths envisaged for both the air and the air/powder mixture are illustrated in the diagrammatic sketch at Figure 3.

An experimental model, No. 2, which is illustrated in Figs. 4(a), (b) and (c) was then constructed in accordance with the design outlined above and subjected to a number of mechanical performance tests. The results of these tests indicated that, provided the dip tube was fitted with a metal foot (to add weight to this component), the mechanical performance of the equipment would be satisfactory. During the course of the mechanical performance tests, however, it became evident that although Experimental Model No.2 appeared to operate satisfactorily and in accordance with the principle on which the design was based its size was such that some reduction in overall dimensions would have to be effected before the equipment could be considered suitable for Service adoption. Accordingly a design based on the same principle of operation, but detailing a duster of reduced dimensions, was prepared and an experimental model (No.3) was constructed.

The results of the mechanical performance and handling tests carried out in Experimental Model No.3, indicated that the duster would be satisfactory in both respects. For the trials carried out to determine the quantity of dust discharged, when the duster is operated in both the horizontal and vertical planes, the following procedure was adopted. The duster was charged with a measured quantity of Anti-Louse Powder A.L.63, Mk. 3 and weighed on a suitable machine. It was then held with the discharge tube lying in the plane required and operated by completing six full strokes of the pump. At the conclusion of this operation the duster was again weighed and the average quantity of dust expended for each stroke of the pump was calculated.

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Since preliminary experiments had indicated that there might be a wide variation in the quantity of powder discharged during individual tests (due to unavoidable variations in the degree of effort applied by the operator), it was decided to repeat the above procedure nine times for each of the three positions in which the discharge tube was held, i.e. vertically upwards, horizontally and vertically downwards. The results of these tests are reproduced in Appendix B.

The results show that the average quantity of dust discharged for each stroke of the pump is about 0.62 g. and is approximately the same for each of the three positions of the discharge tube. The results also show that to secure the required rate of application of dust, three strokes of the pump per application would be required.

In view of the satisfactory nature of the results achieved when operating Experimental Model No. 3, it was decided to proceed with the manufacture of ten prototypes to this design.

Reference to Appendix A indicates that a special fish tail nozzle might be required in the event of the duster being used for the disinfection of manure heaps, etc. To meet this requirement, a fish tail nozzle was designed, constructed and fitted to the Duster in lieu of the plain hole nozzle already described. Tests carried out with this nozzle, however, indicated that the pattern of distribution was very similar to that produced by the plain hole nozzle and that provision of such a nozzle would be of no advantage.

IV. Description of the Duster

The Duster, which is illustrated in Figs. 5 to 9, consists essentially of an air pump, a dust reservoir and a discharge tube. The overall dimensions of the equipment are, length - 26 $\frac{1}{2}$ " , breadth - 5 $\frac{3}{8}$ " and height - 5". It weighs 3 lb. 5 oz. when empty and 4 lb. 3 oz. when charged with 14 oz. of Anti-Louse Powder A.L.63, Mk. 3.

The characteristics and functions of the component parts of the Duster are described below. The flow paths followed by the air and the air/dust mixture, when the Duster is in operation, are identical with those depicted in the diagrammatic sketch at Fig.3.

1. The Air Pump

The air pump, which supplies the air required to convey the insecticide powder from the dust reservoir to the point of application, is of the single acting type, has a bore of 2 $\frac{1}{8}$ " and a stroke of 8 $\frac{1}{2}$ ". The pump body, which takes the form of a cylinder of length, 10" and diameter (outside), 2.554", is made from D31 (.027") tinned plate. The top cover, which is made of the same material, is 2.562" in diameter and $\frac{3}{8}$ " deep. In addition to a centrally disposed hole of $\frac{3}{8}$ " diameter, over which the pump rod guide is soldered, there are, in the top cover, four holes each of diameter $\frac{1}{8}$ " on a P.C.D. of 1 $\frac{1}{2}$ ", which collectively provide access for the air entering the pump. The top cover is fastened to the pump body by two 4BA brass round head screws each a $\frac{1}{2}$ " in length. The pump bottom cover, which is made from D31 (.027") tinned plate and is of the same dimensions as the top cover, has a $\frac{3}{8}$ " diameter hole in the centre.

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The bottom cover is attached to the pump body by solder. The pump nozzle, which is made of brass and has an internal diameter of $7/16$ ", is screwed externally. It projects through the $3/8$ " diameter hole in the bottom cover and is soldered in position. The plunger shaft, which is made of mild steel, has an overall length of $11\frac{3}{8}$ " and a diameter of $1/2$ " except for a length of $3/8$ " (at that end to which the handle, is attached), which is $3/16$ " diameter. That end of the plunger shaft to which the plunger assembly is secured, is screwed for a length of $1/8$ ". The pump handle, which is of length, 3" and diameter, $3/4$ ", is made of hardwood. It is of the "T" type and is held in position on the plunger shaft by means of two washers and the end of the plunger shaft, the latter being rivetted over for the purpose.

The plunger assembly consists of a cup leather, an inner and outer cup leather disc and two $1/2$ " Whitworth Hexagon nuts. The cup leather, which has a diameter of 2" and is $3/8$ " deep, is made of material $1/8$ " thick. In it is a central aperture of diameter $1\frac{1}{8}$ ". The inner cup leather disc, which as its name implies fits inside the cup leather, is made of $1/16$ " thick brass and has a diameter of $2\frac{1}{8}$ ". In the centre is a $1/4$ " diameter hole. The outer cup leather disc, which fits on the outside of the cup leather, is made of 16 S.W.G. (.064") brass, has a diameter of $2\frac{7}{16}$ " and contains a central opening of diameter, $1\frac{1}{8}$ ". The cup leather and its inner and outer discs are held in position on the screwed portion of the plunger shaft by the two $1/2$ " Whitworth Hexagon nuts which, in turn, are secured by two $1/16$ " diameter split cotter pins, each $3/16$ " in length. A coiled spring of free length 1" backed by a $1/2$ " diameter brass washer, is fitted over the plunger shaft adjacent to the plunger assembly. When the pump is being operated on the withdrawal stroke, this spring provides a buffer between the plunger assembly and the pump top cover.

If it is desired to operate the Duster on compressed air from an external source, then the pump is unscrewed, removed and replaced by a B.E.N. or other suitable hand controlled air pistol and the latter is connected to the compressed air supply line.

2. The Dust Reservoir

The dust reservoir, which is cylindrical in shape and fabricated from D.X (.027") tinmed plate consists of a body, top and bottom body covers and a number of auxiliary fittings. The body, which takes the form of an open ended cylinder, is 5" in diameter and $3\frac{1}{8}$ " in depth. The cylinder joint is of the folded and soldered type. The top cover, which is "dished", is 5.056" in diameter and contains two holes. One hole, of diameter $11/16$ ", is disposed centrally, the other, of diameter $1\frac{9}{16}$ " being off-set to one side of the central opening. The bottom cover, the shape and dimensions of which are precisely the same as those for the top cover, has a hole of $11/16$ " diameter disposed centrally. Both the top and bottom covers are cap seamed and soldered to the reservoir body.

The housing for the valve holder, which is made of brass, takes the form of a hollow cylinder of diameter $2\frac{3}{8}$ " and overall depth $1\frac{1}{8}$ ".

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While one end is shaped to fit snugly to the reservoir body, to which it is soldered, the opposite end is screwed internally for a depth of $\frac{3}{8}$ ". A $\frac{5}{16}$ " diameter hole, which serves as an exit for the air on its way from the valve to the dust reservoir, is drilled in one side of the valve holder housing. The valve holder which is constructed from brass is cylindrical in shape, having a diameter of $2 \frac{7}{16}$ " and a depth of $1 \frac{11}{32}$ " deep. A $\frac{3}{8}$ " diameter hole drilled through the centre of the valve holder, is screwed internally to match the screwed portion of the pump nozzle. On either side of this centrally disposed hole at distances of $\frac{3}{4}$ " and $2 \frac{7}{32}$ " from the centre respectively are two No. 4 BA tapped holes, designed to take the screws which secure the non-return valve in position. The valve holder, which is screwed externally, fits into the housing for the valve holder and is locked in position by means of a $\frac{1}{16}$ " diameter split cotter pin, $\frac{1}{2}$ " in length.

The non-return valve which is generally oval in shape and made from .009" thick copper foil, incorporates a lug at each end of the longer axis. One lug contains a hole of $\frac{3}{16}$ " diameter the other a slot $\frac{15}{32}$ " in length and $\frac{3}{16}$ " wide. The non-return valve is attached to the valve holder by two 4 BA Cheese Head brass screws $\frac{5}{16}$ " long each of these screws being held firmly in the required position by a brass washer and check nut. The method of adjustment of the non-return valve is fully described in Appendix C, Section V, Para (4).

A centre tube made of brass is fitted through and extends beyond each of the $\frac{11}{16}$ " diameter holes in the centre of the top and bottom body covers. This tube, which has an overall length of $5 \frac{1}{16}$ " and an internal diameter of $\frac{1}{2}$ " and is soldered in position, is closed at each end by a screwed brass plug. A brass centre piece, $\frac{1}{2}$ " thick and machined to be a push fit in the centre tube, is located at a distance of $2 \frac{1}{32}$ " from one end of the centre tube. It is held in position by a $\frac{1}{8}$ " diameter split pin fitted through both walls of the centre tube and the centre piece itself. This item serves to isolate the longer section of the centre tube from the shorter section. In that part of the surface of the centre tube which lies on either side of the centre line, three rows of $\frac{1}{8}$ " diameter holes are drilled at $\frac{1}{4}$ " intervals. The holes in each row are equispaced and four in number. In that part of the shorter section of the centre tube which lies within the dust reservoir body, four rows of $\frac{1}{8}$ " diameter holes are drilled at $\frac{1}{4}$ " intervals. The holes are equispaced and there are four in each row. At each end of the centre tube but facing in opposite directions, is a $\frac{5}{16}$ " diameter hole. The $\frac{5}{16}$ " diameter hole in the longer section of the centre tube is connected, by means of a suitable length of $\frac{5}{16}$ " O.D., 20 S.W.G. copper tube soldered in position, to the corresponding $\frac{5}{16}$ " diameter hole in the valve holder housing. A second length of $\frac{5}{16}$ " O.D., 20 S.W.G. copper tube serves as a connection between the $\frac{5}{16}$ " diameter hole in the shorter section of the centre tube and the outlet, i.e. the component through which the air/dust mixture passes en route to the discharge tube. The copper tube, which intrudes for about a distance of $\frac{1}{8}$ " into the outlet, is soldered in position at the joint made with each end component.

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The dip tube, or rotor, a single brass casting of overall dimensions $2\frac{1}{2}$ " x $2\frac{1}{8}$ " x 3" comprises a foot (which is radiused to conform with the shape of the inner surface of the dust reservoir body), a connecting stem and a hollow cylinder of length, 1" and outside diameter, $1\frac{1}{16}$ ". The latter is machined internally to a diameter of $.7035" \pm .0005$. The centre tube, which passes through the hollow cylinder portion of the rotor, serves as an axis about which the rotor is free to rotate. The rotor is restrained from horizontal movement on one side by the $\frac{1}{8}$ " split pin keyed through the centre piece and on the other side, by a second split pin of the same size. A $5/16$ " diameter hole drilled through the stem of the rotor provides an egress for the air during its passage from the centre tube to the interior of the reservoir.

The filler cap body, which is soldered over the $1\frac{9}{16}$ " diameter opening in the dust reservoir top cover, is made of tinned plate XL(.0152"). It is circular in section, of diameter 2" and has an external rolled thread. The filler cap, which is made from tinned plate CL(.0092"), has an internal rolled thread to match that on the filler cap body. The edge of the cap has a milled face to facilitate removal. A $1/16$ " thick cork washer is fitted inside the cap.

The outlet component, which is made of tinned plate D3(.027") and takes the form of a hollow funnel, is of lapped seam construction. It has a diameter of 2" at the wide end and $\frac{1}{2}$ " at the narrow end and is $3\frac{1}{8}$ " in length. The wide end is shaped to fit snugly against the dust reservoir body and is soldered in position. There is a $5/16$ " diameter opening in the side of the outlet, through which the copper tube connecting the centre tube to the outlet intrudes to a depth of approximately $\frac{1}{8}$ ".

3. The Discharge Tube and Nozzle

The discharge tube, which is made of tinned plate D3X(.0272") has a diameter of $\frac{1}{2}$ ", is $6\frac{1}{4}$ " in length and of lapped seam construction. A brass collar of diameter $11/16$ " and width, $\frac{1}{2}$ ", soldered over one end of the tube, serves as a holding piece when pushing the tube on to the outlet. The nozzle, which is made of brass and takes the form of a venturi has an overall length of $1\frac{1}{2}$ ". The internal diameter of this component varies from a $\frac{1}{2}$ " at one end, through $\frac{1}{4}$ " in the centre to a $\frac{1}{8}$ " at the other end. It fits into the end of the discharge tube and is soldered in position. The edges of the outlet portion of the nozzle are rounded so that no injury shall be sustained by personnel undergoing disinfection. The overall length of the discharge tube and the nozzle is 7".

4. Transit Case

A wooden transit case, designed to house the Duster, a spare cup leather and a tin of grease, is available for transporting the equipment as required.

V. Instructions for Use, Care and Maintenance

Provisional instructions for the use, care and maintenance of the sprayer have been prepared and are reproduced in Appendix C.

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VI. Performance Tests

The ten prototype Dusters manufactured by the Trade were delivered to C.D.E.E., when complete, for examination and test. The examination revealed that oversized cup leathers had been fitted in the pumps and these had to be replaced before the mechanical performance tests could be undertaken. The results of these tests indicated that the prototypes were satisfactory.

One Duster was then selected at random and submitted to a test to determine the quantity of dust discharged when the equipment is operated in both the horizontal and vertical planes. The procedure adopted for this test was identical with that employed in the test performed on Experimental Model No. 3 (see Section III). The results of the test are reproduced in Appendix D.

The results indicate that the average quantity of dust discharged for each stroke of the pump is about 0.68 g. and that it is approximately the same for each of the three positions in which the discharge tube was held. The results again indicate the variation, (to which attention has already been drawn) in the quantity of powder discharged in individual tests due to variation in the effort used by the operator. It is considered that the operator should be warned of this and it is thought that when he has had an opportunity, over a period of time, to get used to the 'feel' of the Duster, the effort used and therefore the quantity of powder discharged will both be more constant than that found in these tests.

On completion of the tests nine of the ten prototypes available were distributed to various testing agencies, both at home and overseas. Reports from these agencies on the performance of the Duster, are awaited. The remaining prototype Duster, which was retained at C.D.E.E., was used for a test designed to determine, qualitatively, the degree to which the requirement that "the dust, on discharge, should be blown with such strength that it reaches up the sleeve and to all parts of the garments", could be met. The procedure adopted in the performance of this test is outlined below.

A subject equipped with two sets of khaki battledress, two khaki shirts, one set of summer underclothing and one set of winter underclothing, was employed for the test. For the purposes of the test the Duster was charged with 14 oz. of a mixture of Anti-Louse Powder, A.L. 63, Mk. 3 (90% by weight) and salicylaldazine (10% by weight). (The latter compound, which fluoresces in ultra-violet light, was employed as a characterizer). The test was divided into two parts. For the first part of the test, the subject was dressed in short summer weight underpants, short-sleeved summer weight vest, shirt, battledress tunic and trousers; in the second part, long winter weight underpants, long-sleeved winter weight vest, shirt, battledress tunic and trousers, were worn. The method of disinfestation employed was generally in accordance with that laid down in a pamphlet prepared, in February, 1945 by O.C., No. 3 Entomological Field Unit, R.A.M.C., A.F.H.Q., C.M.F., except that applications to the head and cap were omitted. The method is as follows:-

1st Routine (two applications)

With the arms extended to the sides at shoulder height, insert the nozzle of the duster into each sleeve between the skin and the innermost garment.

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2nd Routine (three applications)

Insert the nozzle of the duster at the front of the neck, between the tunic and the shirt, and direct it downwards first to the left, then to the right and finally, centrally.

3rd Routine (three applications)

Repeat the second routine with the nozzle of the duster between the skin and the innermost garment.

4th Routine (three applications)

Insert the nozzle of the duster at the back of the neck, between the tunic and the shirt, and direct it downwards first to the left, then to the right and finally centrally.

5th Routine (three applications)

Repeat the fourth routine with the nozzle of the duster inserted between the skin and the innermost garment.

6th Routine (one application)

Loosen the trousers at the front and insert the nozzle of the duster between the trousers and the underpants, and direct it downwards.

7th Routine (one application)

Repeat the sixth routine with the nozzle of the duster inserted between the skin and the underpants.

8th and 9th Routines (one application for each)

Repeat the sixth and seventh routines at the back of the trousers.

10th Routine (two applications)

Insert the nozzle of the duster, directed upwards, into each trouser leg, between the skin and the innermost garment.

In following the method of disinfestation described above, three strokes of the pump of the Duster were made for each application of dust. At the completion of each part of the test the subjects' clothing was carefully removed, one garment at a time, and turned inside out. Each garment was then laid on a horizontal surface and two photographic exposures, one in ultra-violet light and one in white light, were made. Removal and reversal of the garments involved some disturbance and subsequent loss of dust. This was particularly so in the case of the cotton garments and when removing the trousers, most of the dust on the inside of the legs of the trousers, being lost during this operation.

The results of the disinfestation test are illustrated photographically in Figures 10 to 14 for summer clothing and in Figures 15 to 19 for winter clothing. It will be noted that the performance of the Duster in so far as the dissemination of the dust to all parts of the garments is concerned, appears to be reasonably satisfactory.

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VII. Conclusions

An insecticide hand Duster, suitable for the de-lousing of personnel blankets and bedding and of novel design, has been developed and a few have been constructed. One of these has been submitted to both mechanical and performance tests, the results of which indicate that the standard of performance is such that submission of the remaining prototypes to the War Office for user trials, is warranted.

From the results of the performance tests it is concluded that, when Anti-Louse Powder A.L. 63, Mk. 3 is employed in the Duster, a rate of discharge of about 0.68 g. per stroke of the pump may be expected, no matter in which plane the discharge nozzle may be held. In addition, the performance of the Duster, so far as the dissemination of the dust to all parts of the garments of a person is concerned, appears to be reasonably satisfactory.

A provisional patent has been filed in respect of the device described in this report.

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Supt., Development Division.

Reference

- (1) Report on Trials with a Prototype Dust Gun (Willett and Robinson)
in accordance with Specification A.188.
The Army School of Hygiene, 14th November, 1945.

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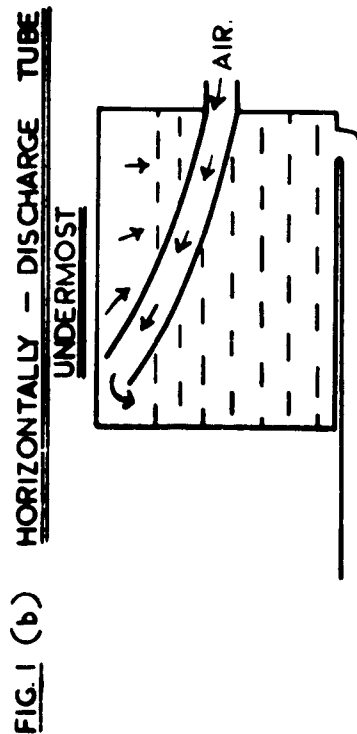
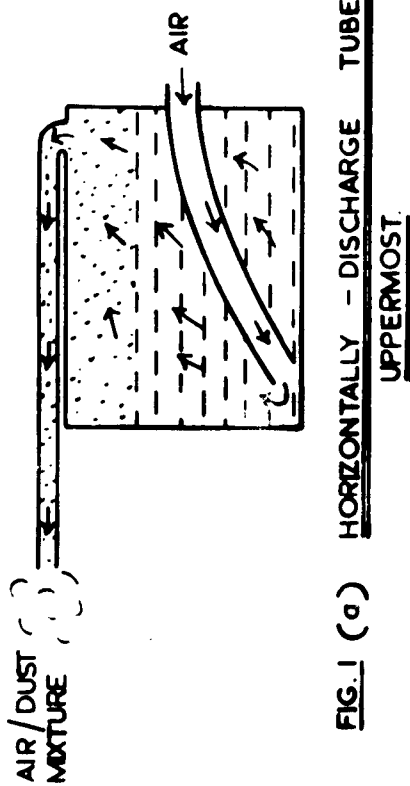
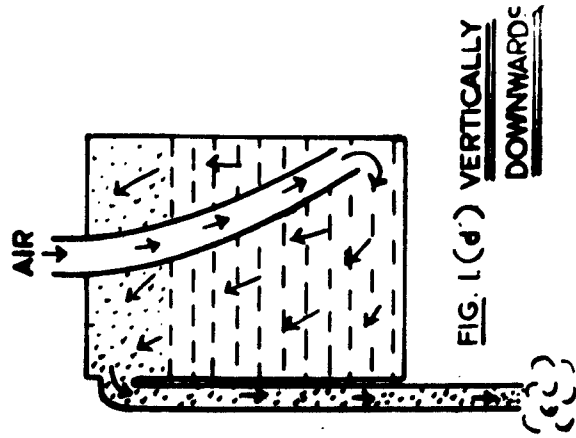
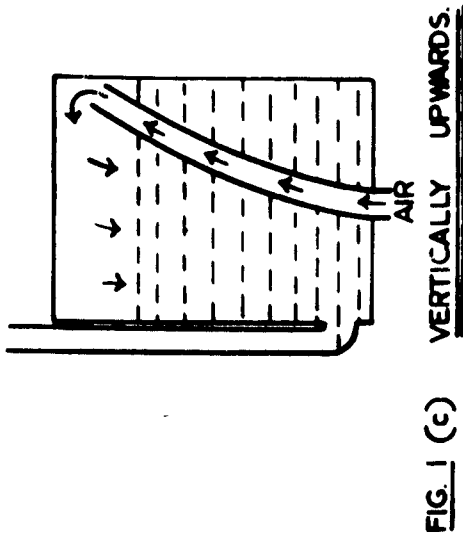
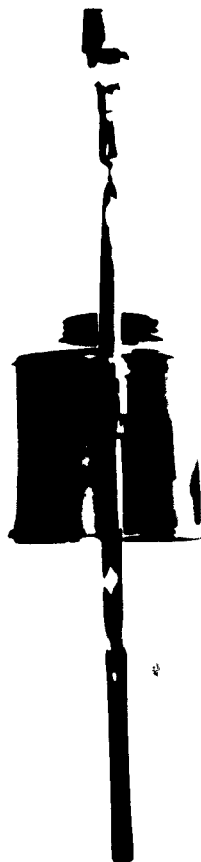
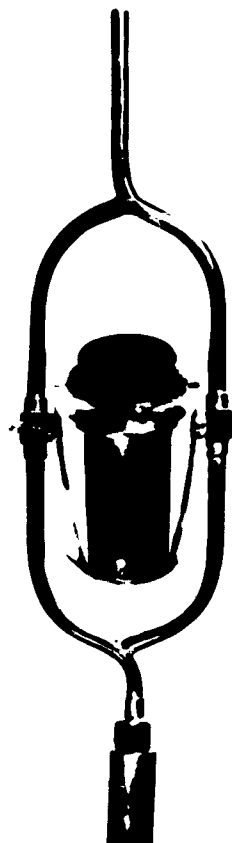


FIG. 1 DIAGRAMMATIC SKETCHES OF A CONVENTIONAL
HAND DUSTER WHEN OPERATED IN VARIOUS
PLANES





(C) DISCHARGE TUBE.
DOWNWARDS.



(D) DISCHARGE TUBE.
UPWARDS.



(B) DISCHARGE TUBE HORIZONTAL — SIDE VIEW.



(A) DISCHARGE TUBE HORIZONTAL — PLAN VIEW.

FIG. 2. HAND DUSTER — EXPERIMENTAL MODEL No. 1.

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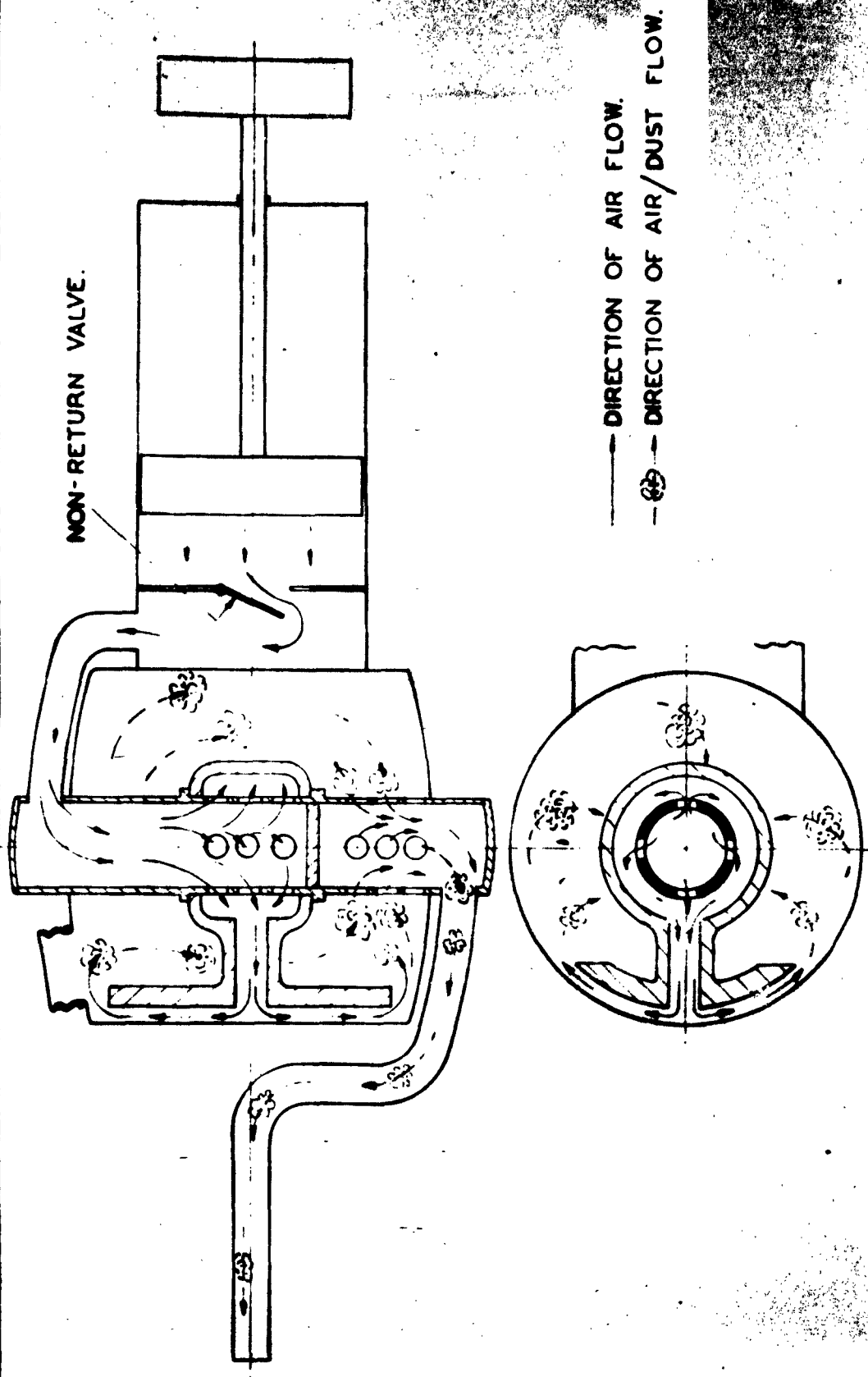
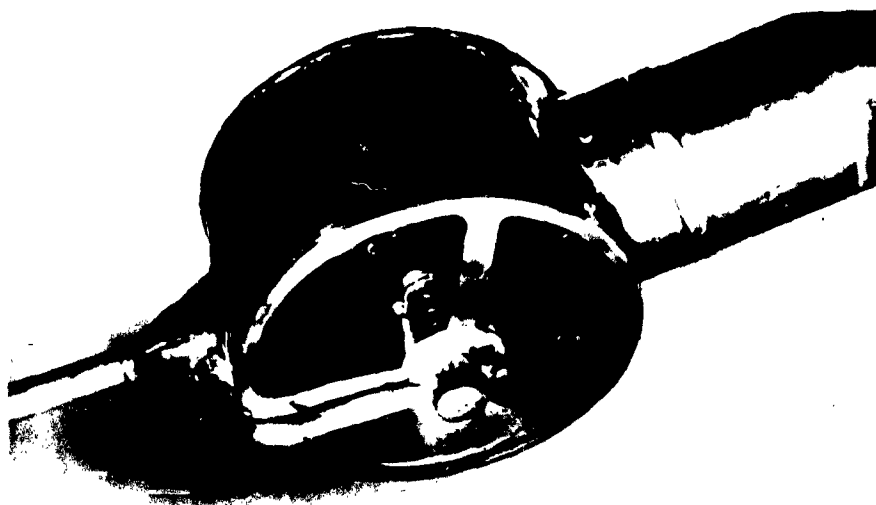
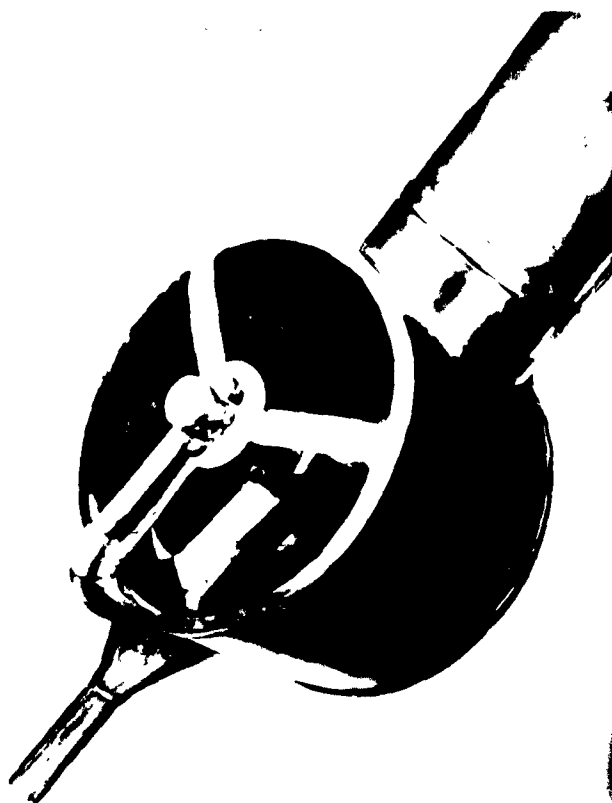


FIG. 3. FLOW PATHS FOLLOWED BY THE AIR AND THE AIR/DUST MIXTURE IN EXPERIMENTAL MODELS ME2A.1.



(B) DISCHARGE TUBE HORIZONTAL.



(A) DISCHARGE TUBE POINTED DOWNWARDS. T. 100/2

FIG. 4. HAND DUSTER — EXPERIMENTAL MODEL NO. 2.

(C.) DISCHARGE TUBE
POINTED UPWARDS

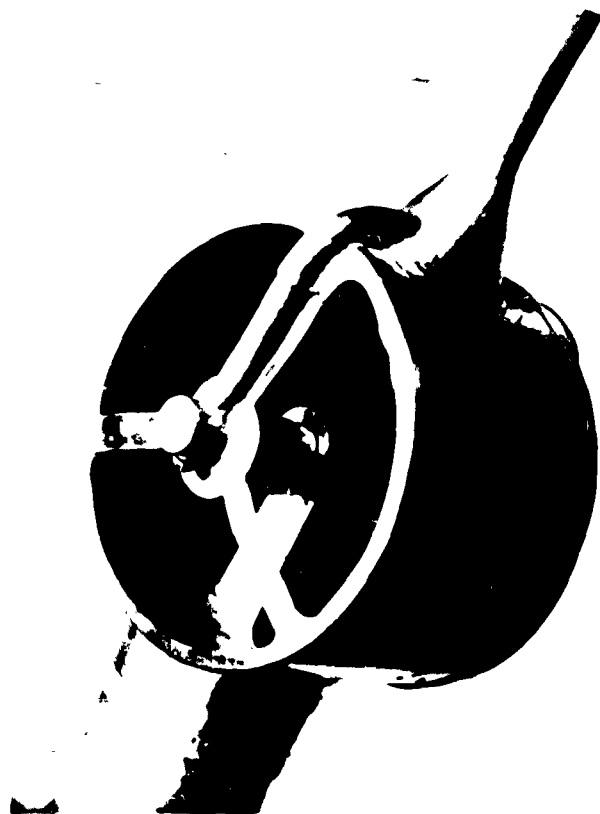


FIG. 4 HAND DUSTER EXPERIMENTAL MODEL № 2.

T. 303/3



FIG. 5. THE DUSTER — PLAN VIEW.



FIG. 6. THE DUSTER — SIDE VIEW.

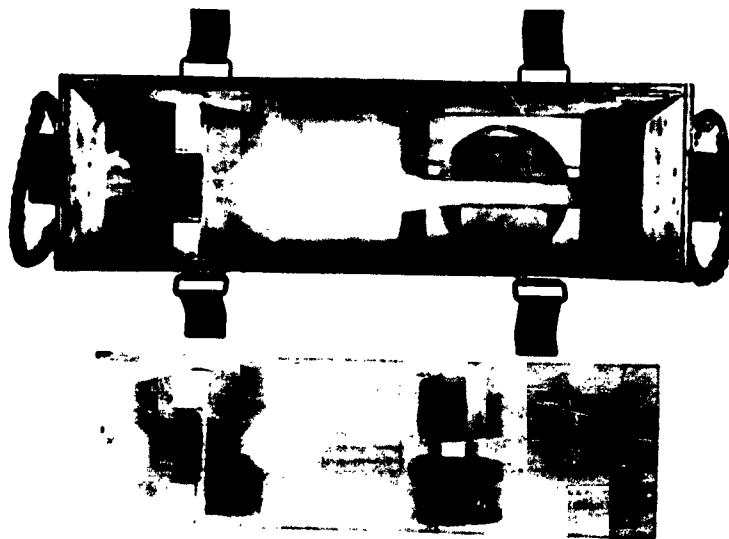


FIG. 7. THE DUSTER — TRANSIT CASE.

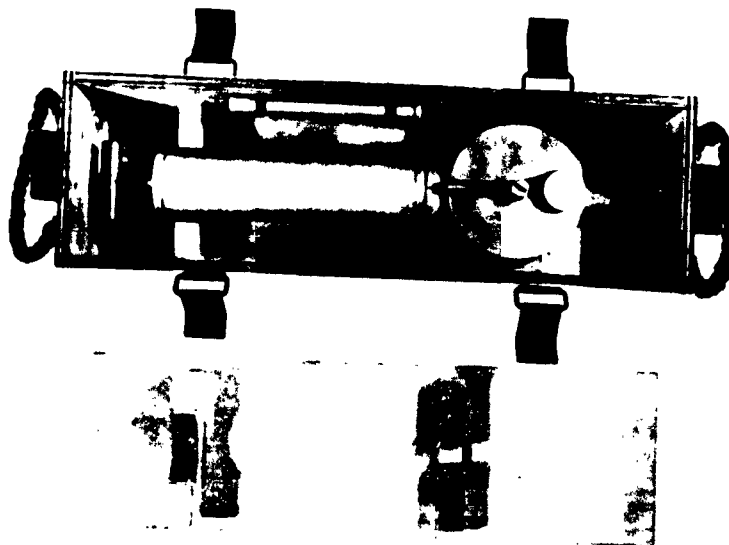


FIG. 8. THE DUSTER — TRANSIT CASE.

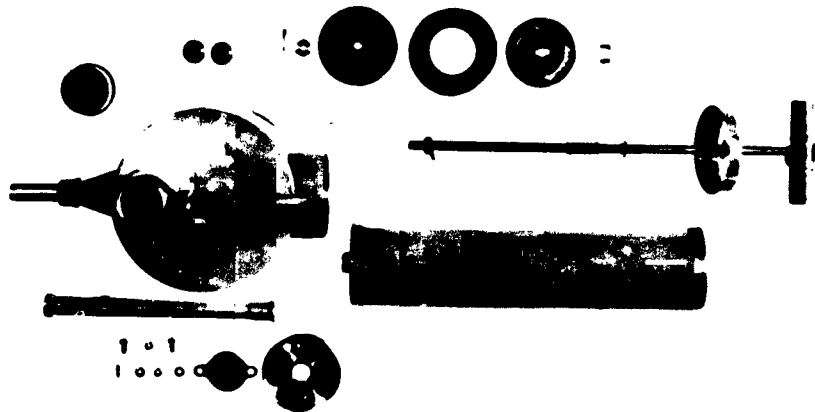


FIG. 9. THE DUSTER — EXPLODED VIEW. T.903/6



FIG 10 TUNIC



FIG. II. TROUSERS.

A. 13/6



FIG. 12 SHIRT.

P. 11/57

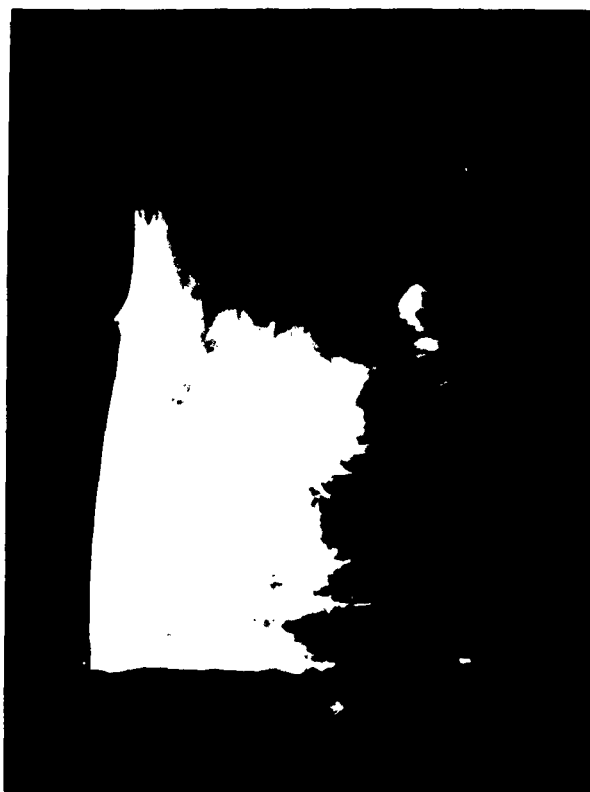


FIG. 13. UNDERVEST.



FIG. 14. UNDERPANTS.

T. 9.13/6

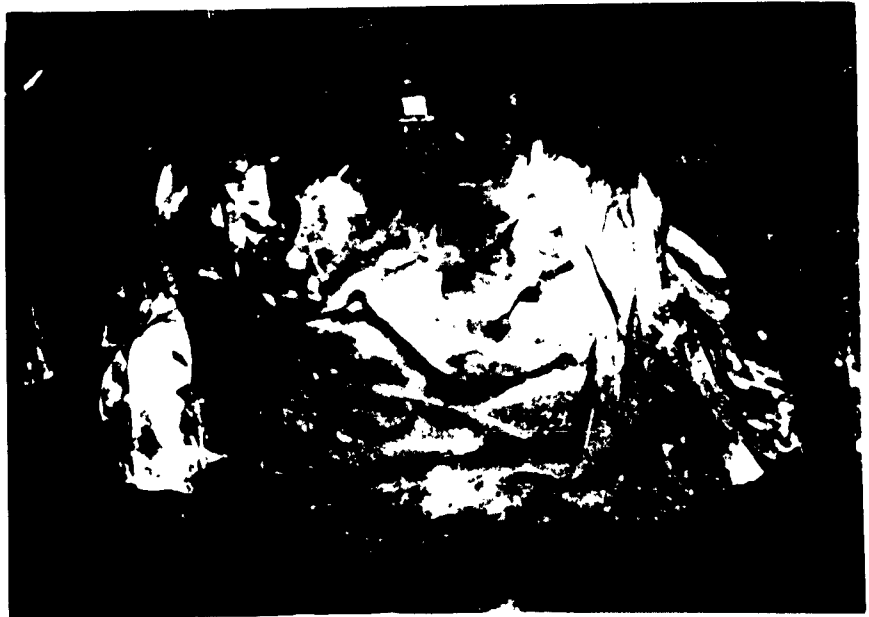


FIG. 15. TUNIC.



FIG. 16. TROUSERS.

T. 903/9



T. 903/10

FIG. 17. SHIRT.



FIG 18 UNDERVEST



FIG. 19 UNDERPANTS.

T. 003/11

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Appendix A

War Office Requirement for an Insecticide
Dust Gun

1. It is required for the de-lousing of personnel, blankets and bedding by the application of anti-louse powder. There is also a possible requirement for the dusting of manure heaps, bug and insect infected buildings, etc. and for this purpose a special fish tail nozzle may be required.
2. It should be adaptable for use by either hand or compressed air.
3. The dust must be blown with such strength that it reaches up the sleeve and to all parts of the garments. The volume of discharge of the powder should be constant at any angle at which the dust gun is used.
4. It should not weigh more than 3 lb. when full.
5. It must be simple and robust in construction with no loose parts that can be easily lost. All parts must be easily accessible, including the pump the piston of which should be detachable to allow repair.
6. It must be easily refillable.
7. The nozzle end should be suitably buffered and should be easily detachable. The length of the discharge pipe should be 7".
8. Washers and valves should be of oil resisting materials.

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Appendix B

Quantity of Dust Discharged by Experimental Model No.3

TEST No.	Plane in which the Discharge Tube was held and Quantity of Dust Emitted (g) Per Set of Six Strokes.		
	Horizontal	Vertically Upwards.	Vertically Downwards
1.	1.0	1.0	0.8
2.	1.0	0.5	0.7
3.	0.3	0.3	0.5
4.	1.1	0.5	0.7
5.	0.5	0.7	0.5
6.	0.3	0.5	0.3
7.	0.5	0.7	1.1
8.	1.3	0.3	0.3
9.	0.3	0.5	0.3
AVERAGE	0.7	0.56	0.58

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Appendix C

Provisional Instructions for the Use, Care and
Maintenance of the Porton Insecticide Hand Duster

I. Description

The Duster, its component parts and the transit box in which it is carried are illustrated in Figs. 1 to 4 attached.

The Duster comprises a Dust Reservoir (1), an Air Pump (2) and a Discharge Tube (3) (the number quoted after each item is the reference number of that item on Fig. 4). The discharge tube is a plain metal tube and is attached to the dust reservoir by means of a "push-fit" connection. The air pump is a single acting pump of normal design and is fitted with a "T" type handle. The dust reservoir is fitted with a Central Tube (4) which is blanked-off about two thirds of the way along its length and serves as an axis about which the dip tube, within the dust reservoir rotates. Air from the pump enters the central tube via the Pump Connecting Pipe (5), passes through holes in this tube and thence down the dip tube and into the dust at the bottom of the dust reservoir. The air/dust mixture leaves the dust reservoir via a second set of holes in the central tube and after passing through the Discharge Tube Connecting Pipe (6) makes its exit through the discharge tube.

It will be apparent from the above description that no matter whether the discharge tube be pointed horizontally, vertically upwards or vertically downwards the foot of the dip-tube and the dust will remain always at the base of the dust reservoir. This arrangement ensures that the rate of discharge of the insecticide dust remains substantially constant irrespective of the plane in which the discharge tube is held.

As will be seen from a perusal of Fig. 4 the component parts of the Duster are readily accessible.

II. Assembly for Use

A. General

- (1) Remove the Duster and the Discharge tube from the transit box.
- (2) Connect the discharge tube to the dust reservoir.
- (3) Ensure that the dust reservoir is clean and dry.

B. Hand Operation

- (1) Ensure that the Plugs (7) at each end of the central tube are securely fitted.
- (2) Ensure that the pump is working freely.

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C. Compressed Air Operation

- (1) Unscrew the pump from the dust reservoir.
- (2) Screw a D.E.N. or other suitable hand controlled air pistol into the dust reservoir adaptor and connect the former to a supply of compressed air.

III. Instructions for Filling

- (1) Remove the Filler Cap (8):
- (2) Charge the container with 14 oz. of insecticide dust.
Do not overcharge the dust reservoir.
- (3) Replace the filler cap.

IV. Instructions for Use (Hand Operation)

- (1) When operating the Duster ensure at all times that it is held in such a way that the words "Use This Side Up" appear at the top of the dust reservoir.
- (2) It has been estimated that about 43 g. of insecticide dust, administered in 25 separate applications is required for the de-lousing of one man and four blankets. Hence the required rate of application of dust is 1.7 g. per administration. Since the Duster discharges approximately 0.6 g. per stroke of the pump, three strokes per administration are required to effect the discharge of the appropriate quantity of insecticide dust.

V. Care and Maintenance

- (1) After use and before putting the Duster away remove any powder that may be left in the dust reservoir and pump air through the system.
- (2) If access to the central tube should be found to be necessary unscrew (using a coin for this purpose) the screw plugs at each end of this tube.
- (3) In the event of the pump not operating freely disconnect same from the dust reservoir and remove the Top Cap (9). Withdraw the Plunger Shaft (10) and grease (using the grease provided) the plunger assembly consisting of the Cup Leather (11), the Inner Cup Leather Disc (12) and the Outer Cup Leather Disc (13).
- (4) Should the non-return valve on the dust reservoir require adjustment, access to this item may be gained by unscrewing the Valve Holder (14) (having first removed the split pin which secures this component to the Valve Housing (15)) and the screws which hold the Non-Return Valve (16), in position.

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The valve itself is formed from thin copper sheet and it is essential that it be seated accurately, otherwise leakage of powder into the pump will occur. When replacing the valve on the valve holder ensure first that one screw is securely tightened. Then tighten up the second screw until that end of the valve secured by this screw can lift an amount equal to one quarter of a turn of the screw. The second screw is then fixed in position by tightening the lock nut on the opposite side of the valve holder.

- (5) A spare cup leather is supplied with each duster.

PORTON INSECTICIDE HAND DUSTER.

FIG. 1.

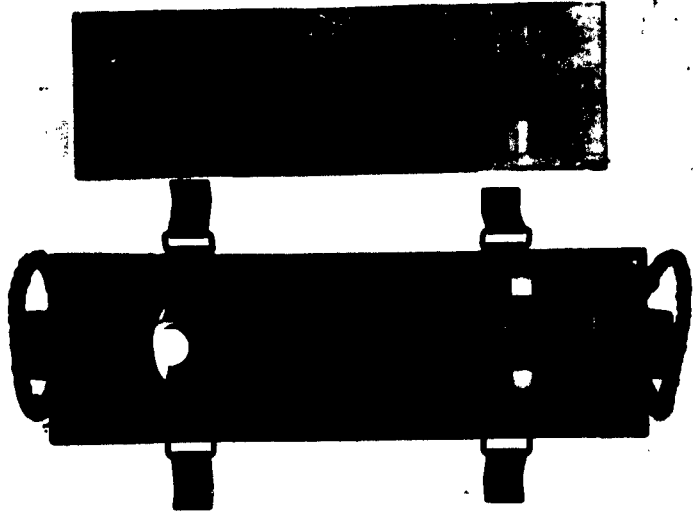


FIG. 2.

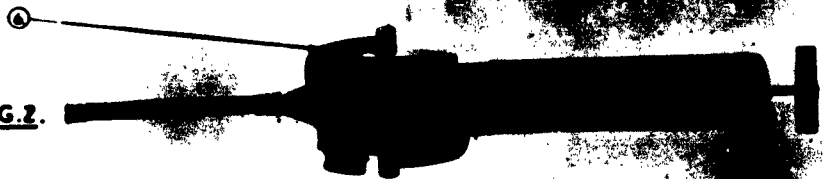


FIG. 3.

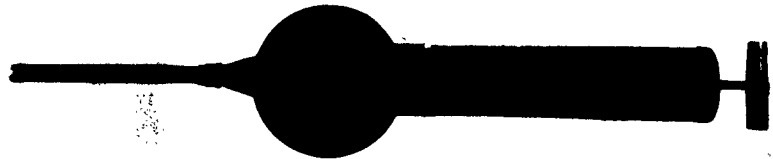
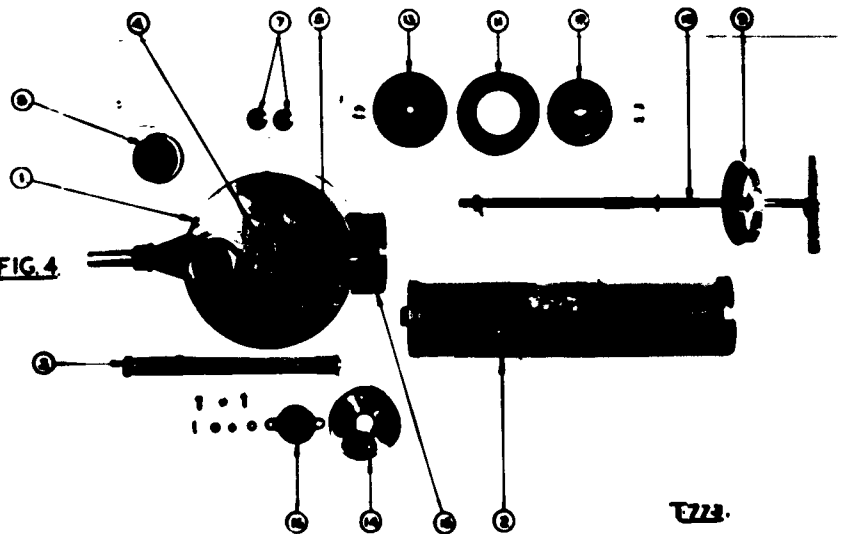


FIG. 4.



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Appendix D

Quantity of Dust Discharged by one Duster
selected from ten Prototype Models.

TEST No.	Plane in which the Discharge Tube was held and Quantity of Dust Emitted (g) Per Set of Six Strokes		
	Horizontal	Vertically Upwards	Vertically Downwards.
1.	0.7	0.8	0.4
2.	0.5	0.6	0.5
3.	0.7	0.8	0.5
4.	0.8	1.0	1.2
5.	0.6	1.0	0.8
6.	0.7	0.3	0.8
7.	0.8	1.1	0.8
8.	0.7	0.8	0.5
9.	0.5	0.5	0.2
AVERAGE	0.67	0.76	0.63

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P.T.P. 348

CIRCULATION
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P.D.S.R.(D)
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C.S., C.D.E.E.(26)
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D.I.S., Didcot
G.S.2(d)
R.D.Am.2.
Pats.1.
T.P.A.3/T.I.B.(2)
S.A.C.(15) for Offensive Equipment
Committee, C.D.A.D.
File
Members of Chemical Defence
Advisory Board (12).
Members of Offensive Equipment Committee
C.D.A.D.(6)

EXTERNAL

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Title: An insecticide hand duster

Availability Open Document, Open Description, Normal Closure before FOI Act: 30 years

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